A

NEW SYSTEM OF SURGICAL MECHANICS.

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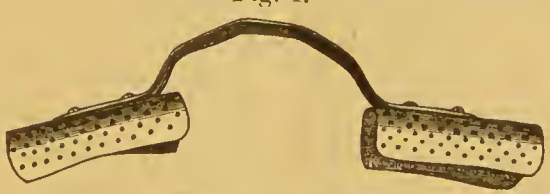
A NEW SYSTEM OF SURGICAL MECHANICS.

GENTLEMEN OF THE AMERICAN MEDICAL ASSOCIATION:—

I WISH to invite your attention to a recital of the methods by which I have partially developed a new system of surgical mechanics, comprising the applications of the sector splint to various diseases of the joints and their deformities, and in order to more fully understand the splint I shall first briefly state a few of the historical facts connected with its development.

Among the surgical appliances which were included in the armamentarium of St. Francis Hospital, New York City, during my term of service as House Surgeon in 1876, was this plain bracket called the "Esmarch" bracket (Fig. 1). This was used

Fig. 1.



Esmarch's joint bracket.

to produce fixation of a joint, and yet allow exposure of surface, but did not allow extension, except such as was produced and imprisoned before the plaster-of-Paris attachments had had time to become firm.

Now, since joints are so constructed that their articular surfaces are held together by muscles, having insertion below and origin above them, it follows that in order to obtain perfect results in the treatment of inflammatory conditions, we must reduce the contractile power of these muscles to a minimum and relieve superincumbent weight—thus removing pressure

from the opposing surfaces. There are several methods in vogue for doing this, but the method I wish particularly to call your attention to to-day, is based upon the proposition that we should endeavor to effect a complete reduction of the contractility of muscles affecting the inflamed joint without diminishing their vitality, relieve superincumbent weight, and yet allow all necessary motion.

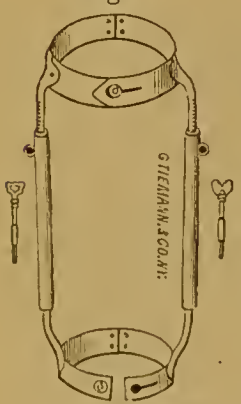
This can only be produced by a splint allowing a *local* extension, *i. e.*, a splint which confines its action solely to the part or joint which is to be treated.

Buck's extension, the modification of the long splint, Hutchinson's method, and that of Thomas, of England, do not possess this qualification, because they involve a whole limb in their action and are *general* instead of *local.*

The splint I have just shown you would produce a local fixation, but would not allow extension or motion.

Now, motion must be allowed when necessary, and our model of a local joint splint should include the power to 1st. Overcome contractility of the muscles. 2d. Relieve superincumbent weight. 3d. Afford support to the joint at any angle the limb may assume. 4th. Allow any degree of flexion. 5th. Allow fixation at any angle. In other words, our local extension splint should produce perfect *rest* of a joint by producing a symmetrical extension of the muscles which govern it, and transferring to the splint the weight of the body and the functions of the joint—leaving the joint itself in the relaxed condition of the joint of a corpse —free from pressure and yet allowed to change its angle as in health.

Fig. 2.

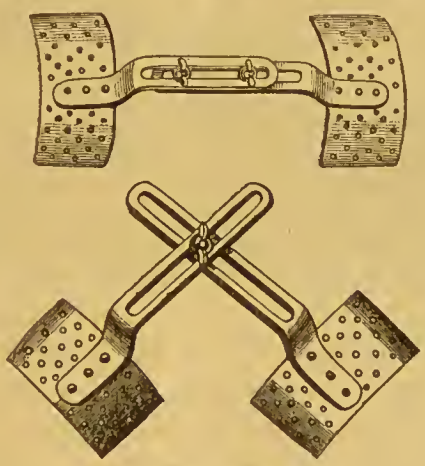


Sayre's knee splint.

Prof. Lewis A. Sayre, of New York, is the inventor of a knee splint which allows local extension in a straight position alone (Fig. 2). This is an improvement upon the one just shown, because while possessing the same *local fixation* it adds to it the power of *increasing the extension* at will, but only in a straight line. Now, so long as there is no tendency to flexion, and no necessity for a long-continued fixation, this would be all that would be required, but in reality the greater number of cases which a surgeon is called upon to treat are those in which flexion has already taken place, for as

a joint begins to inflame, effusion occurs and flexion invariably follows. The application of this splint at such a time is disastrous, because the extension is not exerted in the axes of a limb, and the suffering is increased rather than diminished, for a local splint made to extend a joint when the limb is straight cannot do so properly when it is at an angle, unless it is provided with a joint opposite the affected joint, thus enabling the extension power always to be exerted in the axes of the limb at right angles to the attachments. Recognizing this fact, I devised a bracket in which the bridge was composed of two slotted flat strips, lying one over the other, and connected by two thumb clamps (Fig. 3). This gave me extension and fixation

Fig. 3.



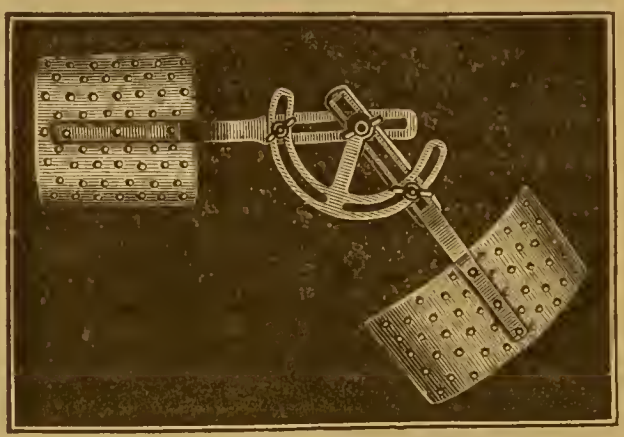
Stillman's slotted joint bracket.

in a straight position, and also enabled me to allow motion by removing one of the clamps.

But this motion was not the automatic motion of a joint, because the one clamp did not possess sufficient fixation to keep itself opposite the joint, and therefore the patient could not use the splint while walking, unless with the limb in a straight position. It, however, did very well for passive motion, which we could exercise, and then lock the joint up in its original position. I subsequently added the sector of a circle, also slotted, both at the centre and circumference, and the mechanical extension joint was complete. You see it before you (Fig. 4). The two slotted strips are now attached to the sector by three clamps, which allow them to play upon a fixed centre taken in space, and when properly applied is capable of the following combinations without removal from the limb:—

1. Extension at any angle with motion.
2. Extension at any angle with fixation.
3. Fixation at any angle.
4. Motion, complete or limited, constant or occasional.
5. Exposure of surface about the joint, admitting compression, elastic or otherwise, hot and cold applications, blisters, dressings, and easy inspection.
6. Motion, extension, and elastic tension by the addition of appropriate rubber cords.

Fig. 4.



This splint may be inserted into any form of brace attachment known. But when it is desired that the splint should remain upon the limb for any length of time, or, as in acute inflammation of joints, where it is used to reduce the contractile antagonism of the muscles, I prefer to use it in the form of a bracket, which is to be attached to the affected part by some immovable dressing, which will be sufficiently inflexible to prevent unequal pressure upon the soft parts.

The sector bracket consists of two terminal plates of thin copper, perforated upon the upper side, connected with each other by a sector bridge raised to any desired distance from the surface. This bridge consists of two overriding slotted steel strips, connected by three clamps which may be either thumb-screws or key-clamps. To this has been added a ratchet upon the upper bar for further increase of extension without alteration of angle.

With regard to the attachment of this bracket, I prefer my combination dressing of swans' down adhesive plaster and flour paste, to the plaster of Paris so much in vogue, because: 1. It

is much lighter. 2. It is more cleanly. 3. It adjusts itself as perfectly to the surface, and has no subsequent expansion or contraction in bulk—one of the chief demerits of plaster-of-Paris. 4. Its adhesive properties.

For example. Suppose the knee to be the affected joint upon which the sector splint is to applied with this dressing. When dry, this upper dressing forms the segment of a hollow inflexible cone which has firmly grasped the muscular structures above the joint—the smaller end of the cone being nearer to the joint—and thus any extensible force which pushes this segment farther apart from the other acts in direct antagonism to the inherent strength of the muscles—causing them to assume less bulk, without reducing their vitality in the least, or interfering with their capillary circulation, and since one segment is over the bulk of the thigh muscles and the other segment is unalterably fixed over their insertion just below the knee-joint, and for a little distance beyond the convexity of the calf-muscles (as some of the fibres of the thigh tendons are finally lost in the fasciæ of the leg), it will be seen, when extension is produced (by pushish up the upper strip of the sector and fastening the upper clamp, leaving the other two loose, thus allowing motion), *that the reflex contractility of the muscles of the joint, and the weight* are both transferred to the sector and its attachments, thus placing the joint in the very best possible condition for recovery by making it to all intents and purposes a dead joint.

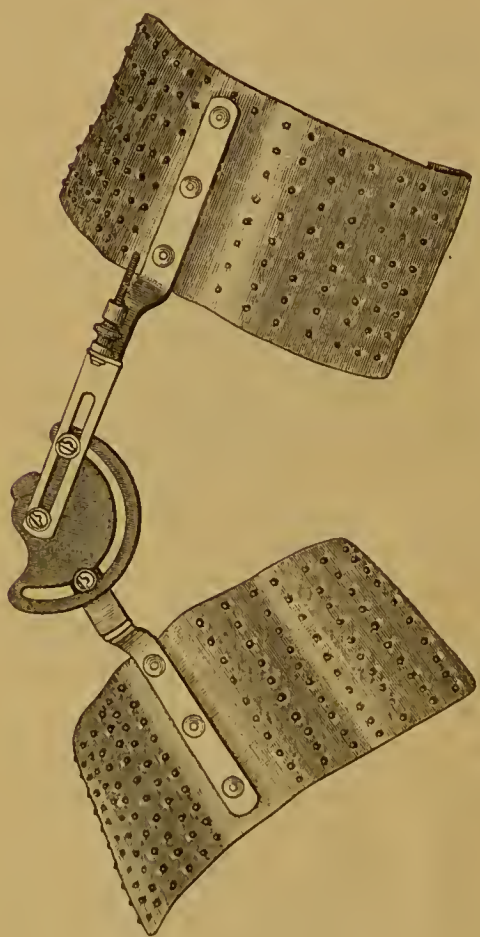
It will be seen, then, that in order to successfully apply a system of *local* extension, whether to joints or fractures, the attachment below the joint must be *fixed unalterably*, and the extension force exerted in the axis of that part of the limb above the joint, and directed against the inherent contractile resistance of the muscular mass governing the joint until it is neutralized by the power of the extending rod. In this way, then, we get our two fixed points, and lift the entire weight of the body off the affected joint without affecting any other part of the limb except that immediately about the joint, which joint is rendered inert and relaxed, and yet a healthy degree of motion allowed to prevent ankylosis.

By the screw upon the upper bar, which I have since added (Fig. 5), increased extension is allowed without change of angle, which is an important quality if fixation is employed. In short, this splint in its various forms is the basis of a new and complete

system of *local extension*, which is applicable to any joint and all conditions of joints, and will prove to be invaluable among the resources of surgical mechanics.

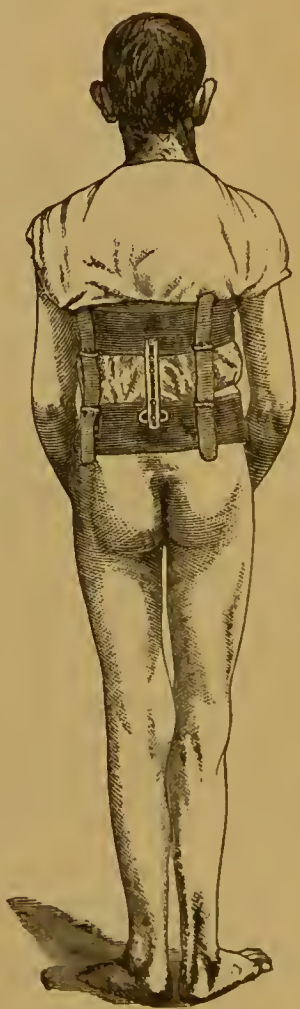
The forms of the sector splints vary according to the part affected. For muscular deformities of the spine it is of the shape shown (Fig. 6), and accomplishes more than any other form of

Fig. 5.



Stillman's sector joint bracket—1881.

Fig. 6.



Sector back brace applied.

spinal dressing now in use. It bears the same relation to the plaster jacket that the sector knee-joint splint does, to confining that joint in an immobile cast of plaster allowed to set while heavy weights are attached to the limb to produce extension. *You imprison extension* in a fixed position, but you do *not* get *motion* or *exposure* of surface, or the opportunity of combating muscular inequality by appropriate rubber cords, which are necessities in

the most successful treatment of all forms of deformities due to or accompanied by muscular insufficiency. Nor can you change the amount of extension at will. Now all these things the sector back splint allows you to do at pleasure, and is, therefore, not only an agent for relief but for permanent cure. Your fixed point is the pelvis, and you lift the superincumbent weight off the affected portion of the spine and transfer it to the splint, and at the same time, by the use of appropriate elastic cords, you relieve all deformities due to muscular insufficiency as far as they can be relieved by mechanical means.

HIP-JOINT.

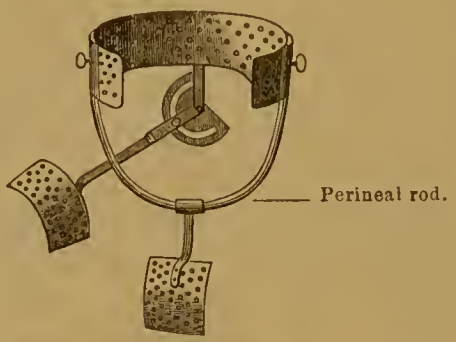
For affections of the hip-joint the splint is applied externally, and is also provided with a horizontal movement for rotation of the thigh when desired. (Fig. 7.)

Fig. 7.

For cases where extreme extension is desired, a metallic perineal curve attached to the waistband and playing in a grooved

rod attached to the thigh piece, I have devised in addition to the external sector (see Fig. 8). It must be noticed, however,

Fig. 8.



Showing perineal extension rod.

that this metallic perineal curve does not, like the perineal bands of the hip splints now in use, touch or impinge in any

Fig. 9.

Stillman's sector hip brace.

way upon the skin, and thus does not cause tension upon the adductor tendons. This tension upon the tendons of the adductor muscles, which is a certain accompaniment of the disease when treated by splints possessing a perineal band which comes in contact with the skin, does not occur, and the increased reflex spasms caused by the pressure of the perineal band, and which cause an apparent shortening of the limb, are prevented. The sector joint is always opposite the hip-joint in whatever position the patient may be, and the amount of extension also remains the same in every position.

By the use of this splint we take the weight of the body off the joint, and by making the sector do its work, the joint is given true physiological rest.

A detachable jointed rod may be passed down to the centre of motion of the foot where it can be attached by a pivot to the shoe, and elastic power properly placed to allow the foot to be inverted or everted at will. (Fig. 9.)

KNEE-JOINT.

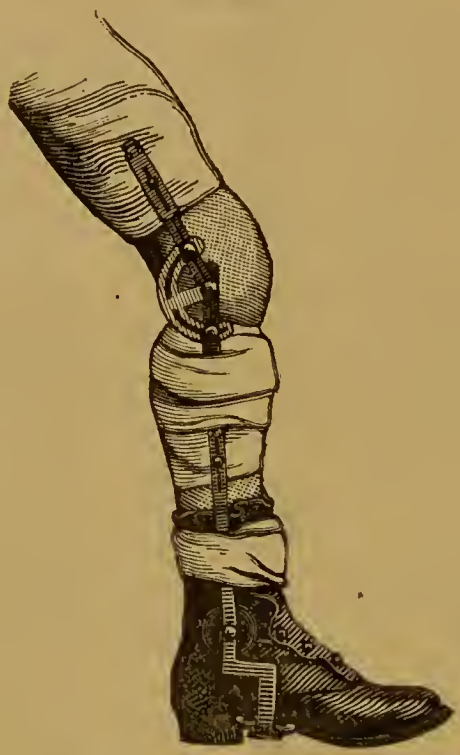
For the knee two sectors are usually required—one upon each side of the joint (Fig. 10); and, if the patient must be upon the

Fig. 10.

Stillman's sector knee brace.

limb considerably, it is usually better to pass a rod, jointed at the ankle, to the centre of motion of the foot where it is pivoted, and thus fix the attachment below the knee unalterably and still allow free movement of the foot (Fig. 11). It is necessary in all

Fig. 11.



cases to fix the attachment below an affected joint unalterably, *i. e.*, so that it cannot be pushed away from the joint by any extension power used, so that the weight of the body above the joint may be lifted away from it by the extension bar of the splint, and the motion of the joint, which is necessary to health, not be complicated by pressure, which is injurious in disease.

There are several points or surfaces which can be connected to the attachment below a joint to render it firm. For the lower extremities, this is the centre of motion of the foot.[1] For the trunk, the pelvis; and for the arm, the hand.

ANKLE-JOINT.

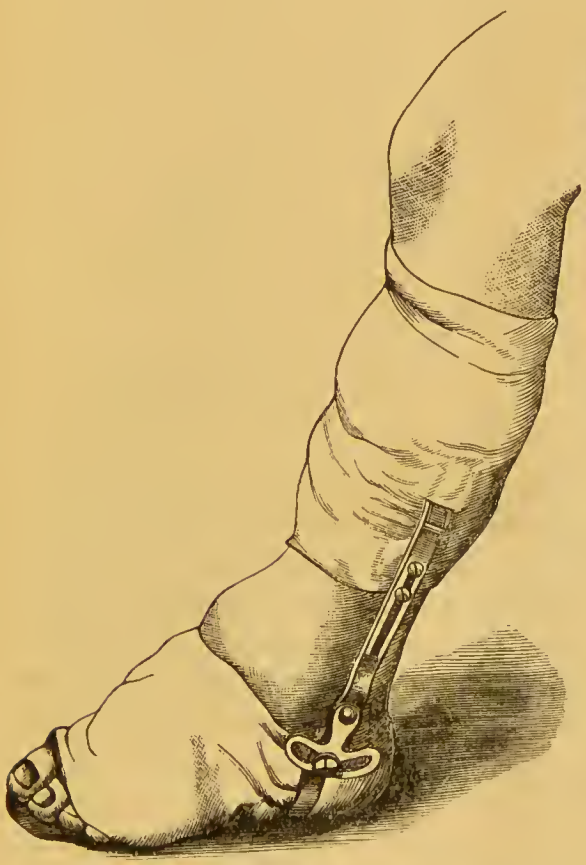
For the ankle, the splint is constructed as shown in Figs. 12 and 13, and is very serviceable. It is attached inferiorly to a sole of leather or felt moulded to the plantar surface of the foot,

[1] See Transactions of the American Medical Association, 1880.

and bound down with some firm dressing. It allows motion, and yet removes all undue pressure from the articular surfaces, and will be found of use in all varieties of injury or inflammation in or about this joint.

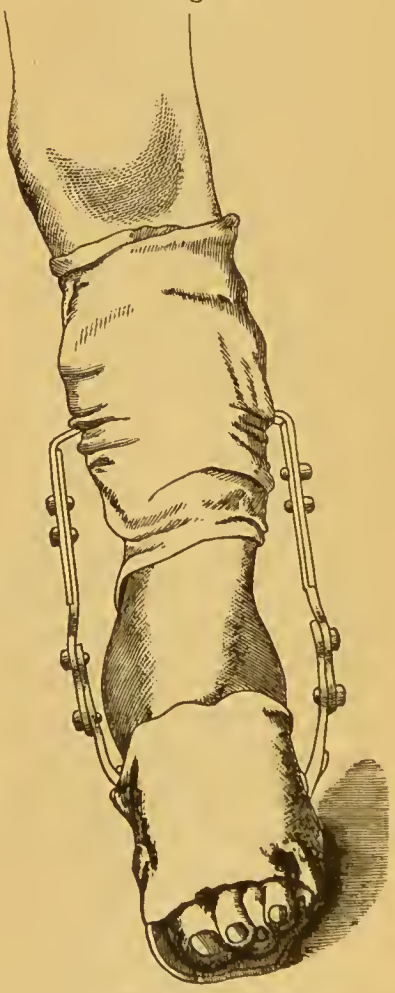
For the elbow, the sectors are somewhat smaller than for the knee, and in general the same form, made small in proportion, is used for the smaller articulations.

Fig. 12.



Stillman's sector ankle brace.

Fig. 13.



The same. Ant. aspect.

FRACTURES.

With regard to the use of the sector in fractures, simple and compound, I cannot as yet speak from an extended experience; but in a modified form, adapted to the limbs (see Fig. 14), it seems probable that it may prove a most reliable agent, especially in those cases where exposure of surface, gradual reduc-

tion of deformity, and the effects of *local* extension generally are desired.

Fig. 15 shows its probable application to the thigh.

Fig. 14.

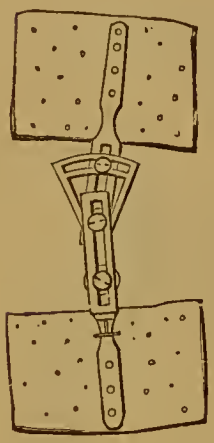


Fig. 15.

In conclusion, let me state that I have tried to outline in as brief a manner as possible, the essential points of this new system of surgical mechanics; but that much is necessarily omitted which is necessary to the proper understanding of the subject. It has, however, progressed to a degree in its development which encourages us to believe that the sector splint will eventually be recognized as one of the most valuable mechanical agents which the surgeon can have at his command.